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Using microsignatures to determine the properties of an electric field at Saturn

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Abstract

In previous work [1] we observed systematic asymmetries at the radial displacements of energetic electron microsignatures from the Saturnian moons Tethys (4.89 R_s) and Dione (6.28 R_s) with respect to local time. These asymmetries were explained by introducing an electric field that is present near the radial distances of Tethys and Dione and has an orientation from noon-to-midnight and a strength that does not exceed 1.0 mV/m. The nature of such an electric field still remains a puzzle. In this work, we present our latest results after updating the microsignature dataset, by including data from the recent Cassini orbits and also including microsignatures from the moons Rhea (8.74 R_s) and Enceladus (3.95 R_s). The observed local-time asymmetry trend continues to persist near Tethys and Dione. We observe a similar pattern for Enceladus, but with less reliable statistics, due to the limited number of detected microsignatures, while for Rhea we have too few events to reach any statistical conclusion. We performed our electric field calculations by setting its orientation as a free, time-dependent parameter and observed significant changes in the electric field pointing. However, we definitely find that the electric field has a component pointing to midnight. The electric field seems to be present in all the studied period (July 2004 - January 2012). We also discuss a possible association of the electric field strength with the solar activity level.

References

[1] Andriopoulou, M., Roussos, E., Krupp, N., Paranicas, C., Thomsen, M., Krimigis, S., Dougherty, M. K. and Glassmeier, K. -H.: A noon-to-midnight electic field and nightside dynamics in Saturn's inner magnetosphere, using microsignature observations, Icarus, doi: http://dx.doi.org/10.1016/j.icarus.2012.05.010, 2012.